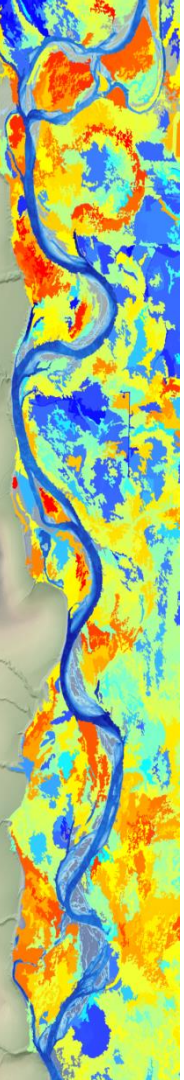


Spatial and temporal patterns of water temperature in streams and rivers of the Delaware River Basin

17 May 2020
Master Watershed Stewards Sensor Station Support Workshop

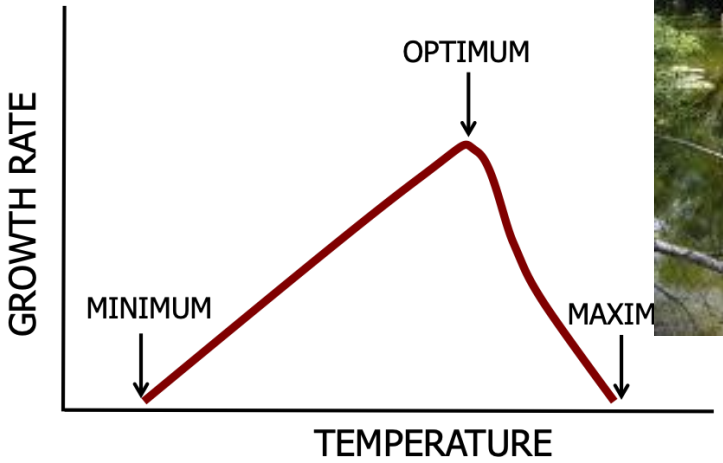
Marc Peipoch, PhD
Assistant Research Scientist

STROUD WATER RESEARCH CENTER

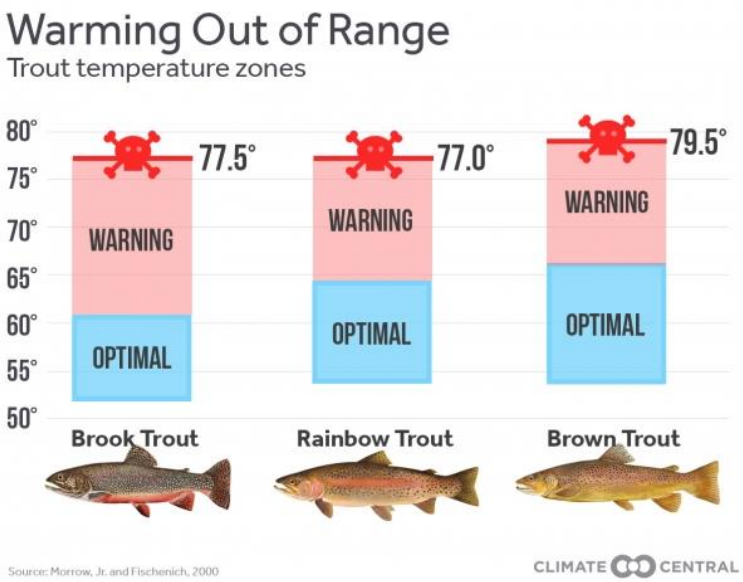
WILLIAM PENN FOUNDATION


Why Temperature?

Temperature affects biological growth



Temperature controls fish presence

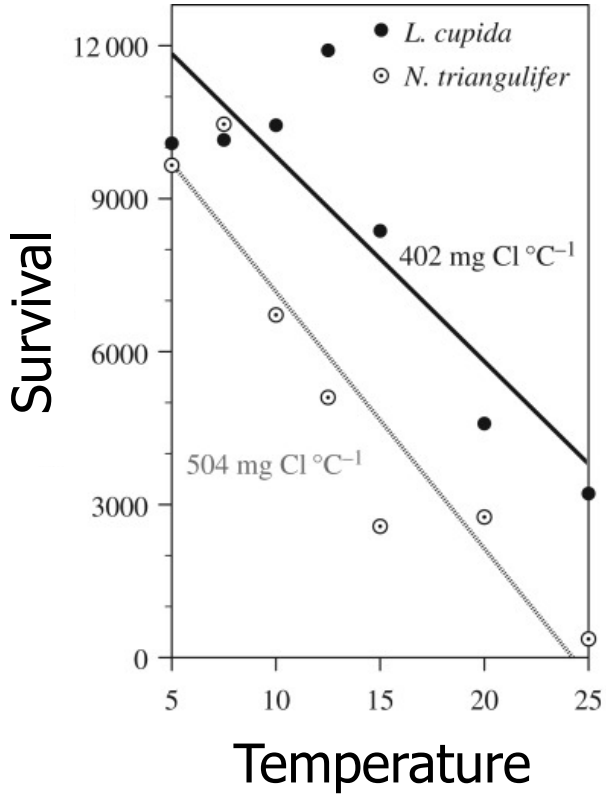


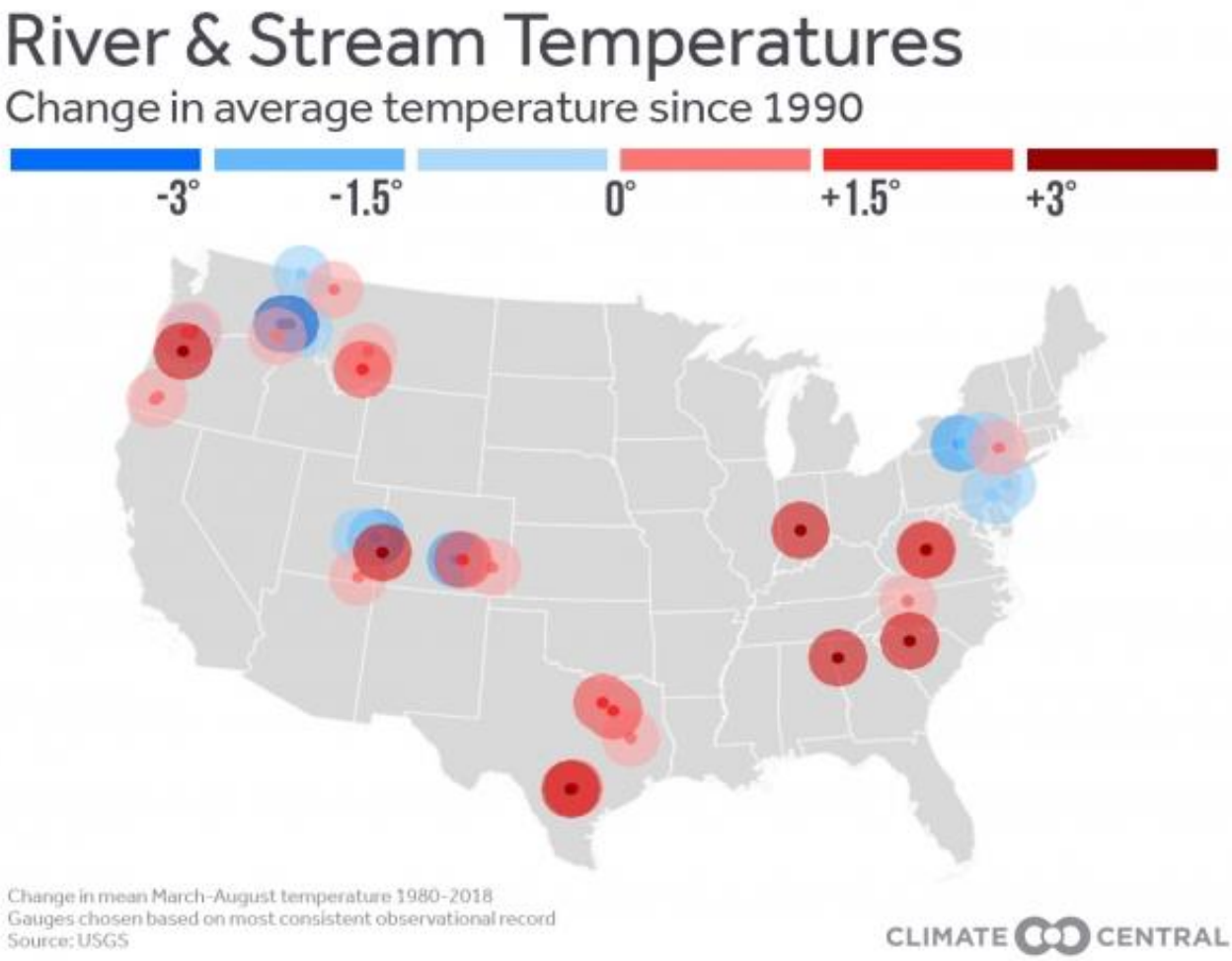
Temperature affects toxicity

Temperature affects acute mayfly responses to elevated salinity: implications for toxicity of road de-icing salts

John K. Jackson and David H. Funk

Stroud Water Research Center, 970 Spencer Road, Avondale, PA 19311, USA





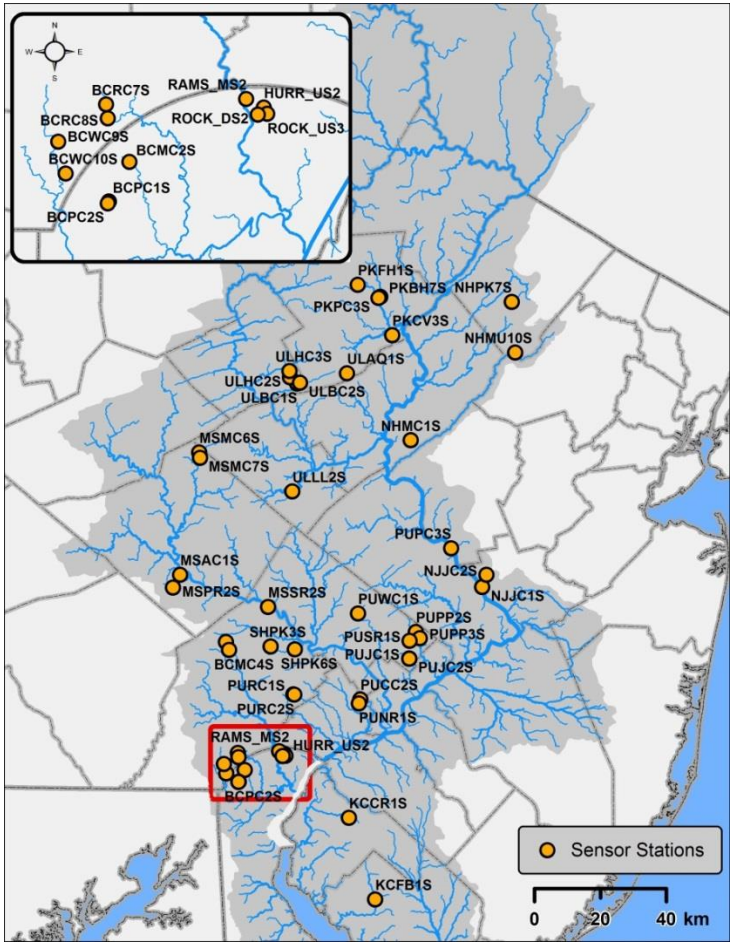
Stream temperatures are rising at 65% of the continental U.S. gauges

EnviroDIY sensor stations

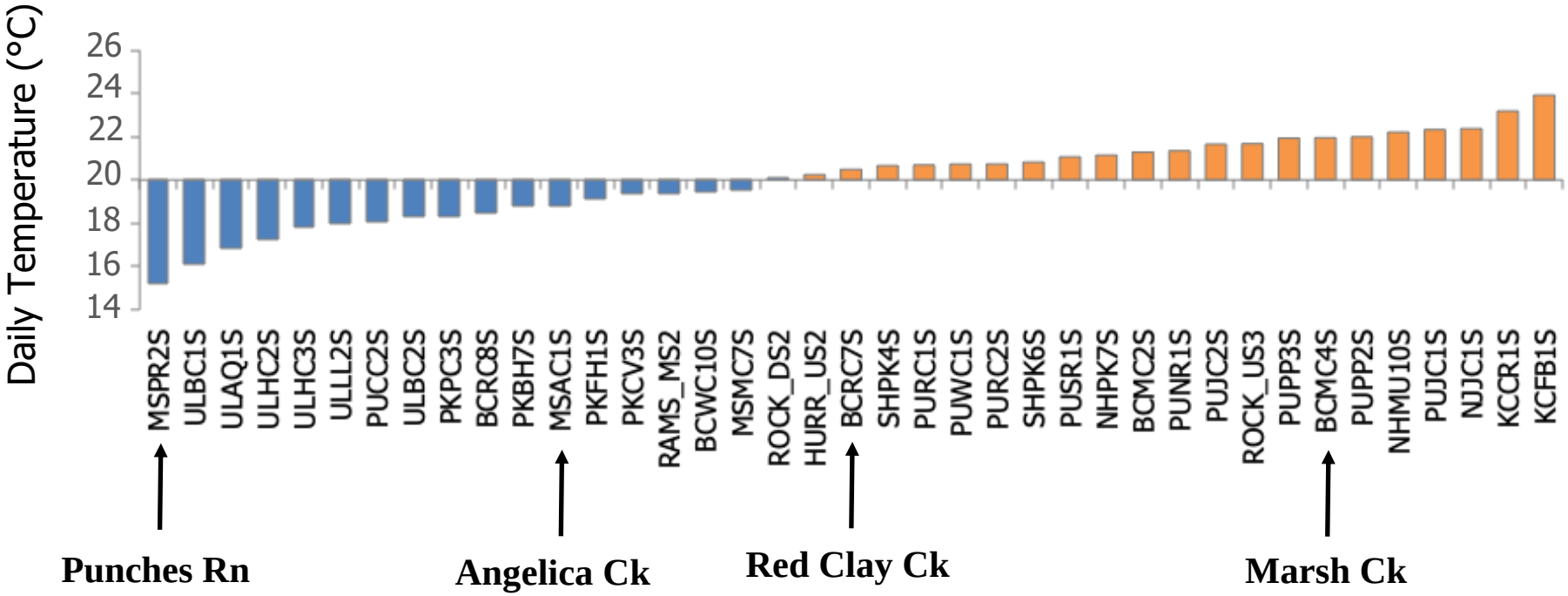
- Conductivity
- Water Temperature
- Depth
- Dissolved Oxygen

Data selection and screening

- DRWI Sensor Network
- Summer data (June-September)
- Data from 2017 and/or 2018
- 50 sites selected



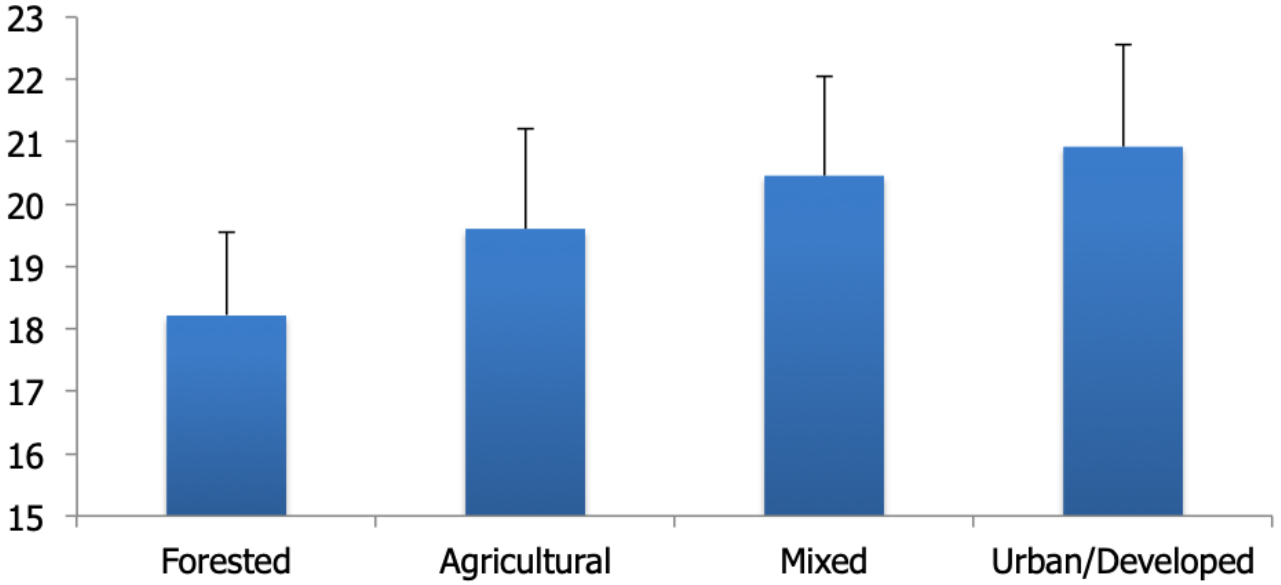
Summer Stream Temperature



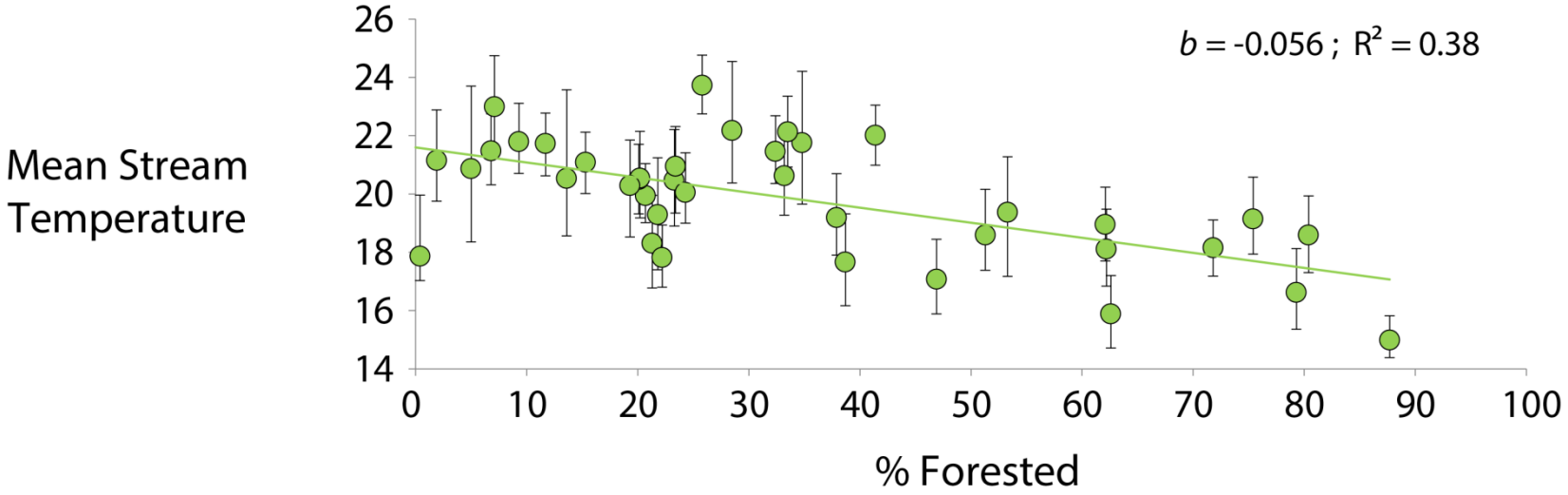
50 sites of different size with varying land uses

Land use and stream temperature

Average Summer Temperature



Forest area and stream temperature

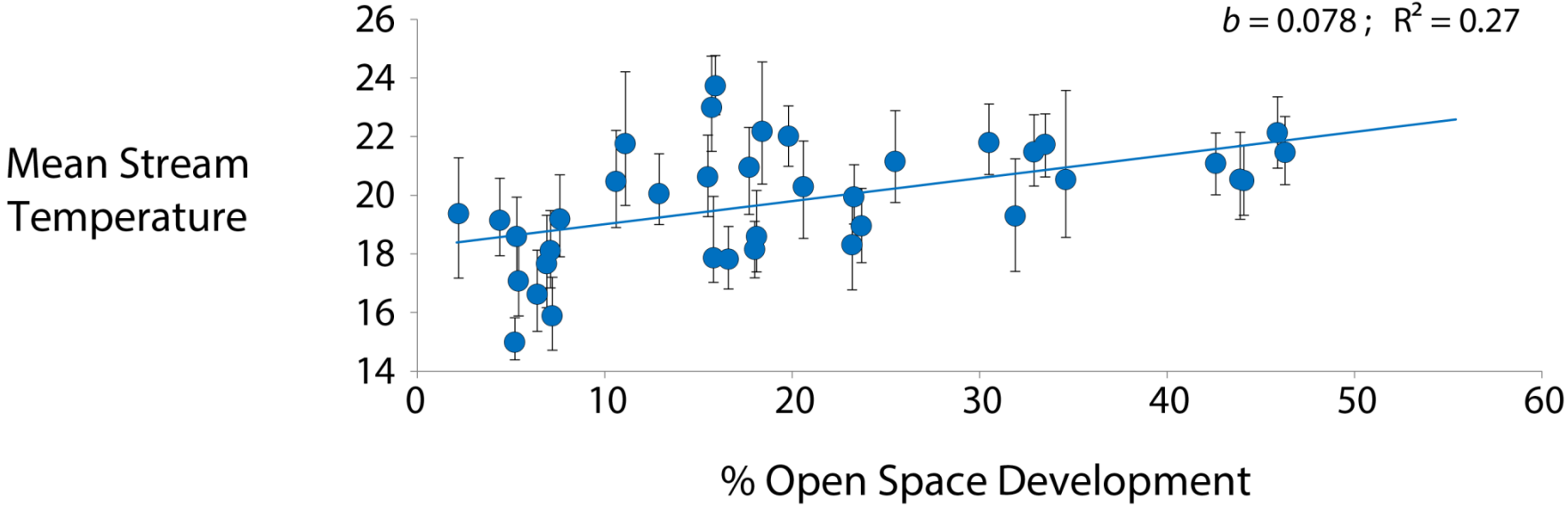


10% forested area yields a 0.5°C decrease

Urban Development and stream temperature

Open development

% Urban or low, med, high development intensity (R^2<0.05)



EnviroDIY sensor stations

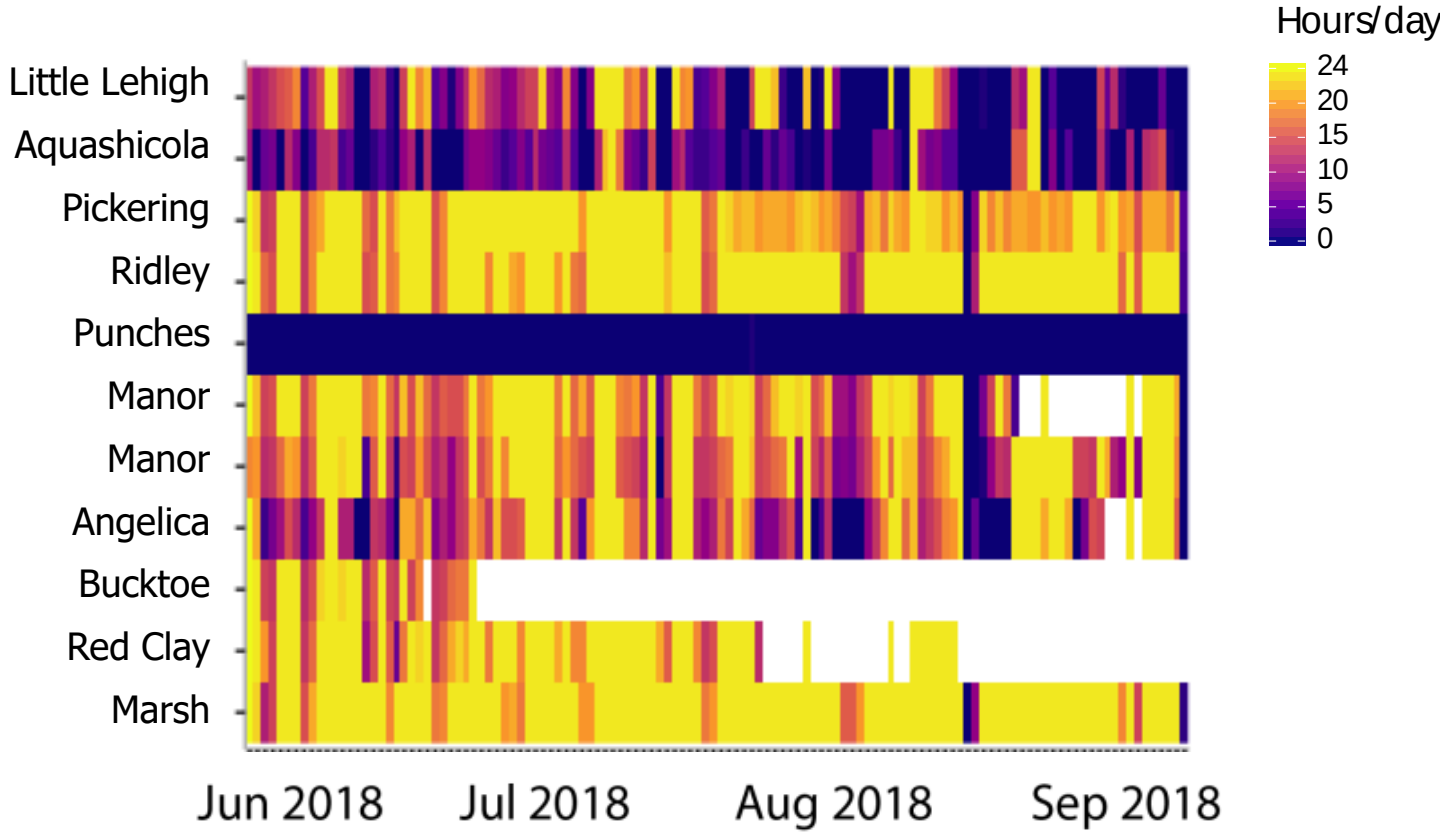
Sentinels of thermal stress in cold-water fisheries

15.5°C – 18.8°C

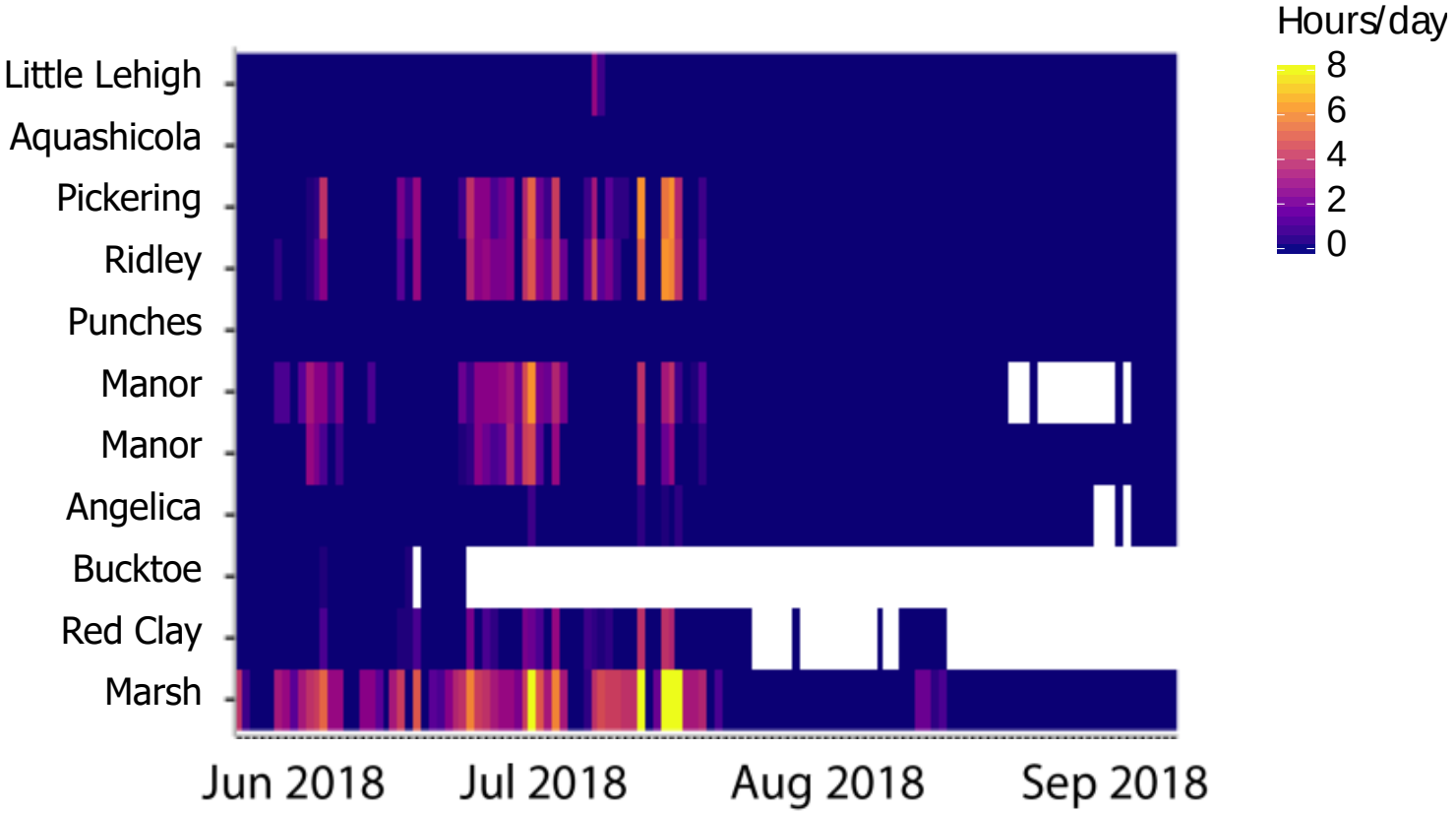
Guidance for trout stocking locations

21°C – 31°C

Hours/day exceeding Cold-Water Criteria



Hours/day exceeding Stocking Temperature Criteria

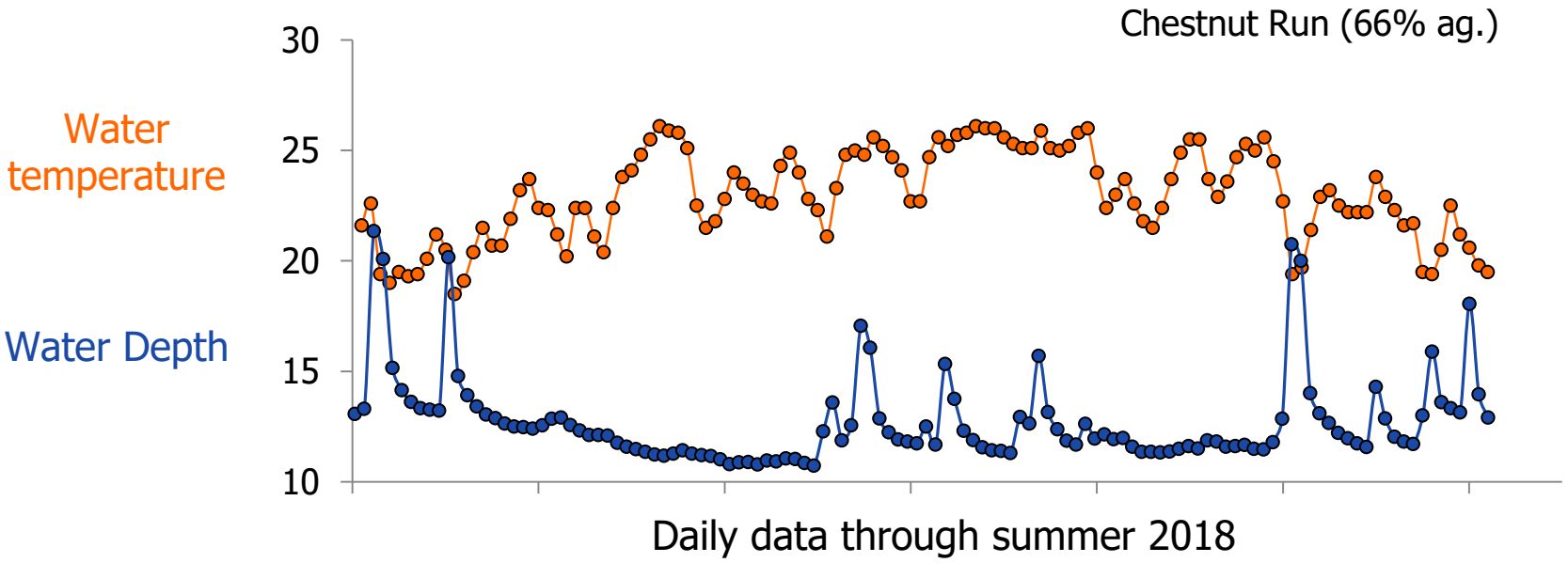


Temperature surges associated with storm events in contrasting watersheds

- A temperature surge was defined as an increase/decrease of >1.3°C over 15 minutes
- Assumed to persist until temperatures had reached ≤1.3°C of the pre-surge temperature

Nelson and Palmer 2007; Utz et al. 2011

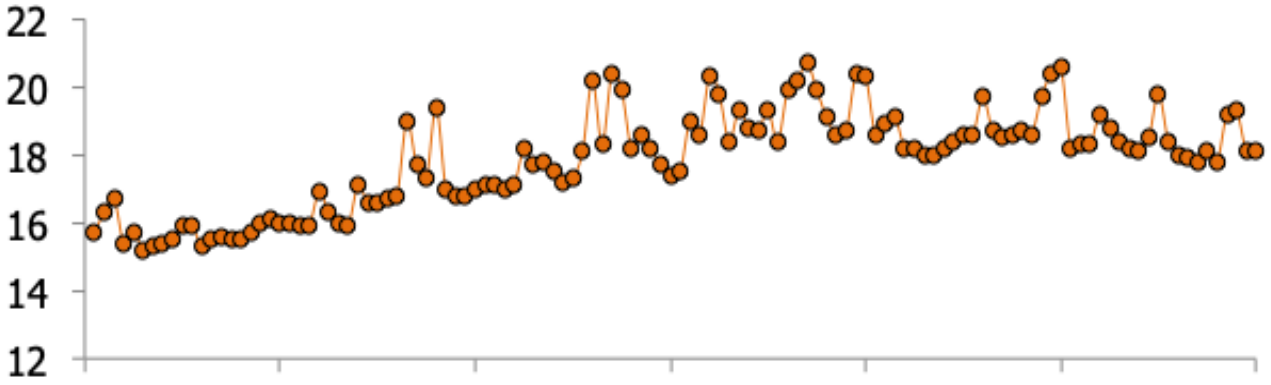
No evidence of temperature surge in most forested and agricultural streams



Decreases in Temperate during Storm Flow

A total of 33 temperature surges registered in Cobbs Creek (88% urban watershed)

Water temperature



Daily data through summer 2018

Increases in Temperate during Storm Flow

In summary

- Significant ‘cooling effects’ of forested watersheds on stream temperatures at the large scale
- Exceedance of state criteria for Cold Water Fish by many hours/days in multiple streams
- Contrasting patterns of stormflow on stream temperatures depending on land use

Acknowledgments

- Citizen scientists
- Collaborators:
  - Diana Oviedo-Vargas
  - John Jackson
  - David Bressler
  - David Arscott
  - Charlie Dow

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